School of Chemical Engineering and Materials Science

OkChE

FALL 1997

OklahomaChemicalEngineer

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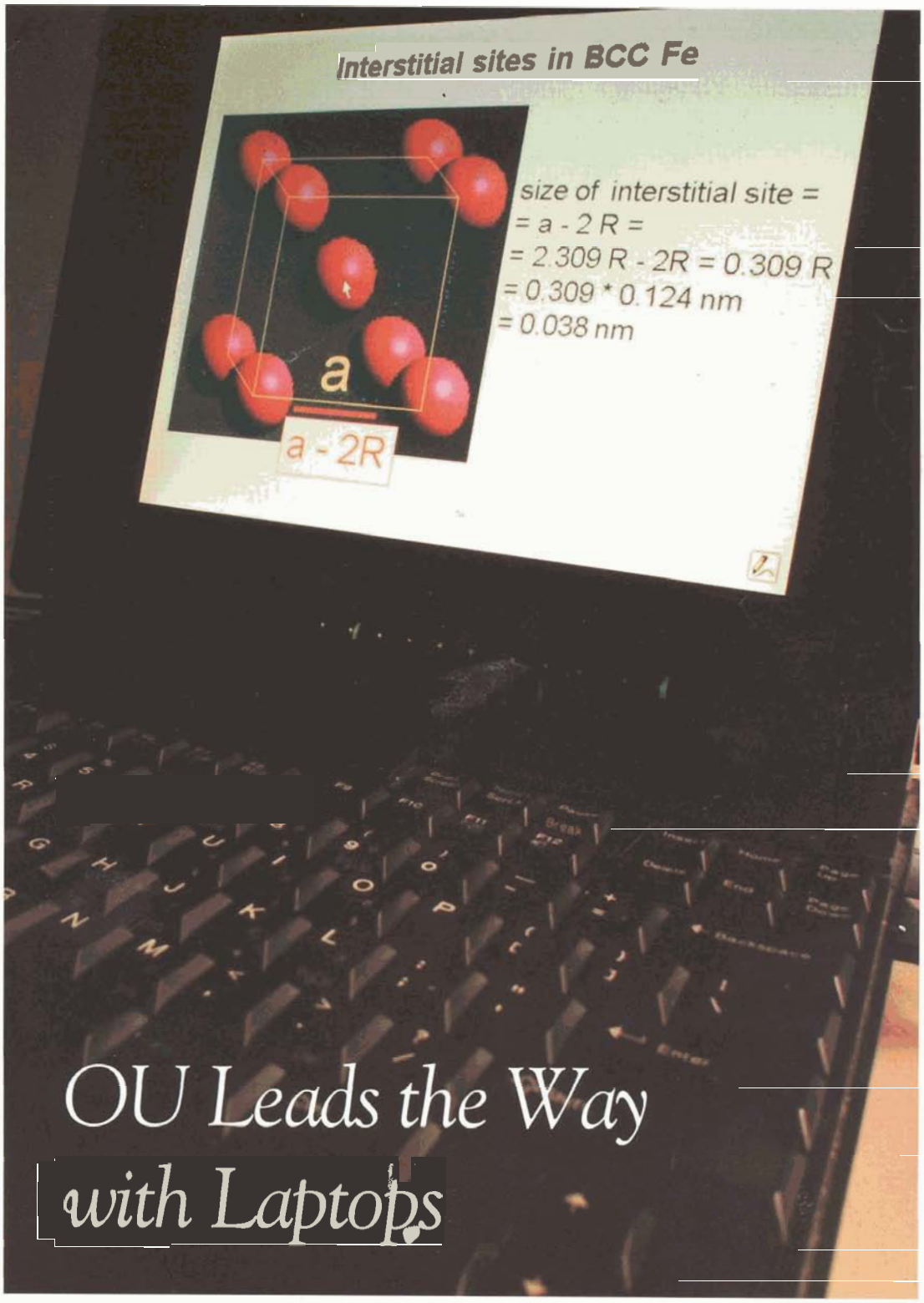

OU Leads the Way with Laptops

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OkChE Magazine
Published by
The University of Oklahoma
School of Chemical Engineering and Materials Science
100 East Boyd, Room T-335
Sarkey's Energy Center
Norman, Oklahoma 73019-0628

OkChE is a production of CEMS.
Executive Editor: Conoco/DuPont Professor and Director Jeffrey H. Harwell
Managing Editors: Lynette Lobban and Debra Krittenbrink
Art Director: Teresa Dotson
Photo Credits: Jaconna Aguirre.

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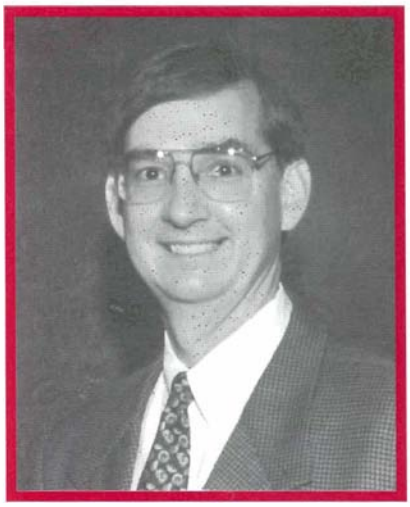
1800 copies have been prepared and distributed at no cost to the taxpayers of the State of Oklahoma.

A Note from the Director



Education is in the throes of the greatest changes since the invention of the printing press.

Today we can't imagine going to school without paper and pencils, books and handouts, but people learned without these tools for centuries. In the next 10 to 20 years, however, computers will become just as central to the learning process as paper, pencils, and books have been for the last 500 years.

Today's college students grew up watching Sesame Street and MTV. They are much more visually oriented than any previous generation of students. This puts a great strain on a professor trying to communicate technical material with chalk and a chalkboard!

The OU College of Engineering and the School of Chemical Engineering and Materials Science have worked hard to attract the best students from Oklahoma and the US. Nearly half of our students rank in the top two percent of college bound high school seniors. We have a higher percentage of National Scholars than any other public university's engineering school, and more in absolute numbers than most universities. We have a young, dedicated faculty and outstanding industry and alumni support. We have no excuse for not being in the lead in setting the pattern for engineering education in the next century.

Consequently, CEMS and OkChE have been strong supporters and proponents of the decision to require notebook computers for all freshmen in the college by the fall semester of 1998. This means that by the fall of 2001, every student in every class in our school will have a powerful notebook computer that can be brought to class. We've gone a step further and decided to link all of these notebook computers in a wireless network with World Wide Web access available from any location within range of the built-in radio receiver that will come with the computer.

In this issue you will read about some of the innovative ways our faculty have begun to prepare for these fundamental changes in engineering education. The classroom is changing. The old lecture style is slowly but surely passing away, along with homework submitted on engineering paper and graphs drawn by hand with a pencil and a straight edge. These changes have already occurred in a significant portion of our undergraduate classes, and the rate of change will accelerate as the notebook computers work their way up the curriculum. I hope you are excited and stimulated by the stories on some of these changes that you read in this issue of OkChE.

This isn't the whole story, however. We don't expect to make the best use of these new tools by just letting things evolve. Instead, the CEMS faculty and the OkChE Board have decided to join forces for a top-to-bottom evaluation of our curriculum in the light of new global engineering education realities and the emerging learning technologies of computers and the Web. Will they require major reorganization of the curriculum, or just changes in how and when the same information is presented? How do we incorporate increased training in communications skills, leadership skills, and teamwork skills without either decreasing the quality of the technical education students receive or increasing the hours they spend in school? How will we assure that our students become creative, thinking engineers rather than people who just push the right buttons, now that the computer has become an integral part of the engineering process?

Stay tuned! This issue of OkChE is just the first installment of a story that will take many years to tell. The first changes are already sweeping into the classroom. We have planned an all-day meeting with the OkChE board on these topics; a full-day faculty retreat is also scheduled just to decide on an outline for an orderly approach for the process and the setting of some realistic goals for our curriculum. We plan to keep you informed. It promises to be an exciting ride!

Yours truly,

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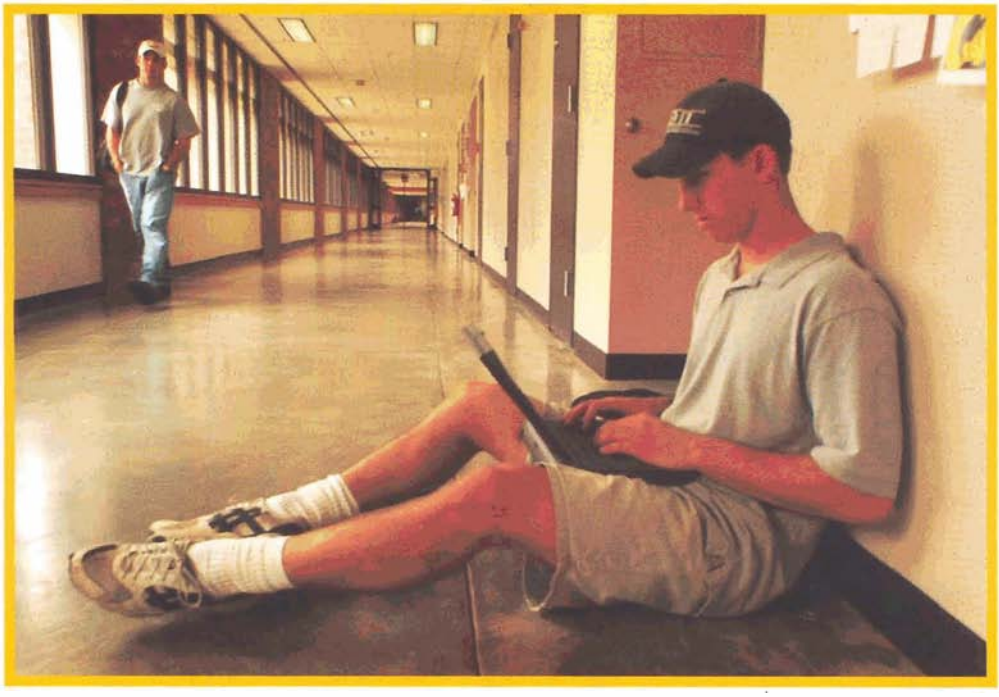
OU Leads the Way With Laptops

Beginning next year, the College of Engineering will join a select group of schools nationwide in requiring all incoming freshmen to have a laptop computer. The mobility and multimedia capabilities of the laptop are revolutionizing learning and teaching, as our faculty and students respond to the business world's increasing demand for computer-literate graduates. The following stories profile four professors who have integrated computer technology into their classrooms.



Chris Lichtenwalter wraps up an assignment while waiting for class.

OU Leads the Way With Laptops

In the fall of 1994, a group of three faculty, four students and John Hawley, manager of the University's Engineering Computer Network, were asked by College of Engineering Dean Bill Crynes to look into the possibility and feasibility of requiring all freshmen entering the College of Engineering to have laptop computers. During that first year, there were a lot of questions, Hawley said, but few objections.

Dean Crynes, Hawley and others visited schools which already required students to own computers, either desk tops or laptops. Hawley recalled one university in particular that dispersed any doubts about pursuing the requirement.

"I visited the University of Minnesota at Crookston, where laptops were required. Until that visit, I was not convinced it was a good idea to require students to have them, although I certainly thought it was a good idea for those who wanted them," Hawley said. "Then I saw the students sitting under trees, in the lunchroom, in the library, immersed in their computers, totally mobile, and I realized this was the way of the future.

"I became a believer. I knew this was the way we must go. We could do it now, or we can do it later, but it's going to happen. And if we stay on the leading edge, we might have a better say in how it's done."

"We discussed for a year what would be the best way to go about it," Hawley said. "Then we decided we would do a pilot program and 33 laptops were purchased. Civil engineering volunteered to be our guinea pig."

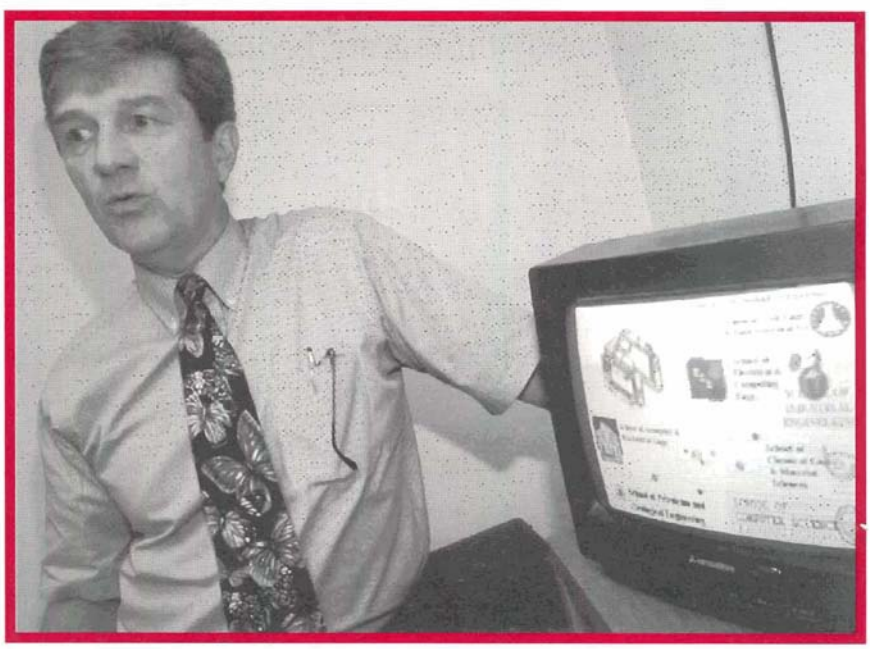
Twenty-four students went through the pilot program, taking courses such as introduction to engineering, graphics, and calculus in special sections designed for laptop students. According to Hawley, the pilot program was "highly successful." Boosted by the positive feedback from students and faculty, Dean Crynes assigned a task force last January to set the program in motion across the college.

This fall, about half the engineering freshmen already have laptops, which they use in five engineering classes and English composition. By next fall, laptops will be as ubiquitious as blue jeans among the freshmen class.

"All the freshmen classes will be laptop sections," said Hawley. "The use of the computer as an engineering tool is that important. The industry must have graduates who are completely capable, competent, and at ease with computers."

Another plus to having computers in the classroom is their potential as a teaching tool, Hawley said. Multimedia instruction is taking wing and the computer from now on is going to be an integral part of teaching and learning. Hawley believes it is something faculty

See Laptops page 5



John Hawley discusses the new laptop program which will take effect in the fall of 1998 at the University of Oklahoma.

Laptops, *continued from page 4*

can use to do a better job and make their job more rewarding. With the laptop, the students will have access to this enhanced visual learning while in class and have the luxury of being able to call up an instructor's notes or send homework from any location.

"To write the multi-media software is a big project and takes a lot of time," Hawley said. "But the rewards are worth the effort." Chemical engineering professors like Miguel Bagajewicz, Daniel Resasco, Lance Lobban and John Schamehorn are already finding innovative ways of using the computer in the classroom. (See stories pages 6 through 12.)

In spite of the all the pluses laptops can offer, Hawley admits there are some downsides. The computers are expensive, around $2400. The size and mobility of the laptop makes it ripe for theft and the possibility of damage is higher than desktop models because of the daily wear and tear of being bounced around in backpacks.

Since the computers are required, financial aid can help take the sting out of the price tag for those who meet the requirements. The price includes a three-year warranty and a loaner program, so students will never get caught without their laptop right before a major assignment or exam.

The University of Oklahoma already has a jump on other schools with its growing number of wireless classrooms. The system, which utilizes radio frequencies instead of hard wiring, dramatically increases the mobility of the laptop. Felgar Hall is totally wireless, as is half of Carson Engineering Building. Sarkeys Energy Center is next on the list for the update. "To my knowledge, we're the only ones right now doing the wireless network," said Hawley. "Our students will enjoy a mobility that allows them do their homework, or access the Internet or the Web without being confined to a desk." ■

John Scamehorn

In the 17 years John Scamehorn has taught at the University of Oklahoma, he has watched the freshman class evolve from a calculator-packing crowd to a technologically sophisticated ensemble, who are as comfortable with computers as their predecessors were with slide rules.

Scamehorn teaches Introduction to Engineering, a core requirement of incoming freshmen. In the past few years, he has seen tremendous change. "When I asked my class three years ago who had used word processing, only half of them would raise their hands. Now all of them have used word processing, and a fair number have already used spread sheets," he said. "It's a big change. When I first started teaching, students usually wouldn't use a computer till their junior year." Now, Scamehorn said computers are very much integrated into freshman classes.

In order for that relationship to get off to a smooth start, students are required to take ENG 1112. "We start by having the student use the engineering computing network, show them how to use their e-mail account within OU, and do some technical writing," Scamehorn said. "This forces them to use MicroSoft Word, which is uniform across the college. Then we introduce them to MicroSoft Excel, which is a spread sheet program — a new concept for most freshmen."

Scamehorn uses Excel to introduce the concept of plotting and graphing data, so students can tabulate their results and graph them, then perform statistical and economic analysis. They then integrate their new computer usage with such topics as statistics and economics and look for engineering solutions.

"They are not only learning computer skills," said Scamehorn, "they are learning the basic ways engineers approach problems." The latter, he said, may be the more difficult concept to teach.

"We used to spend hours teaching numerical methods and how to solve complicated equations. Now, we stick them into the computer and it does all the work for us," Scamehorn said. "The negative is that we need to work even harder to force the student to have some real intuition for what they are doing. We have to emphasize the reason they are being paid as engineers is not their ability as a key punch operator, but their ability to understand the numbers that come out and evaluate them."

Scamehorn said he doesn't want his students to accept an answer just because the computer "spit it out." Engineering students, he said, must go beyond that asking, "Are these figures reasonable, do they make sense?"

In order to strengthen their engineering intuition, Scamehorn still has his students do a lot of calculations by hand. They don't like it, he said, but it helps the budding engineers learn two things. First, they recognize how much easier it is to solve the problems on a computer. And secondly, they can get more of a feel for what the numbers mean and what the computer is doing, having done them by hand.

See Scamehorn inside back cover

Daniel Resasco has been teaching at the University of Oklahoma since 1993. He received his B.S. from the Universidad Nacional del Sur, Argentina in 1975 and his Ph.D. from Yale University in 1983. He is a Janet and Kenneth Smalley Presidential Professor and has been awarded the Harding Bliss Prize at Yale and the B. Houssay Award for Scientific Achievement from the National Research Council of Argentina. He has served as chairman for the Chemical Engineering Department, Universidad Nacional de Mar del Plata; as senior scientist for Sun Company, Inc. Pennsylvania, on the Executive Committee, International Congress on Catalysis; and the Editorial Board of Applied Catalysis.

Imagine you are sitting in a room when on the screen before you a title scrolls up, then rolls into live action, juxtaposed with animated figures. If you're lucky Bruce Willis or James Bond might even make an appearance. Could this be the latest offering from Hollywood's DreamTeam?

Not exactly, but for the typical college classroom, it's pretty exciting stuff. The writer, director and producer of these mini-dramas is Daniel Resasco, a Chemical Engineering professor at the University of Oklahoma, who brings his lectures to life with the help of multi-media presentations and his laptop computer.

For the past two years, the computer has played an increasingly important role in his lectures, homework assignments and class projects. Motivated by a desire to teach students on their own terms, Resasco has incorporated visually appealing graphics and videos into his classes. The results have been impressive.

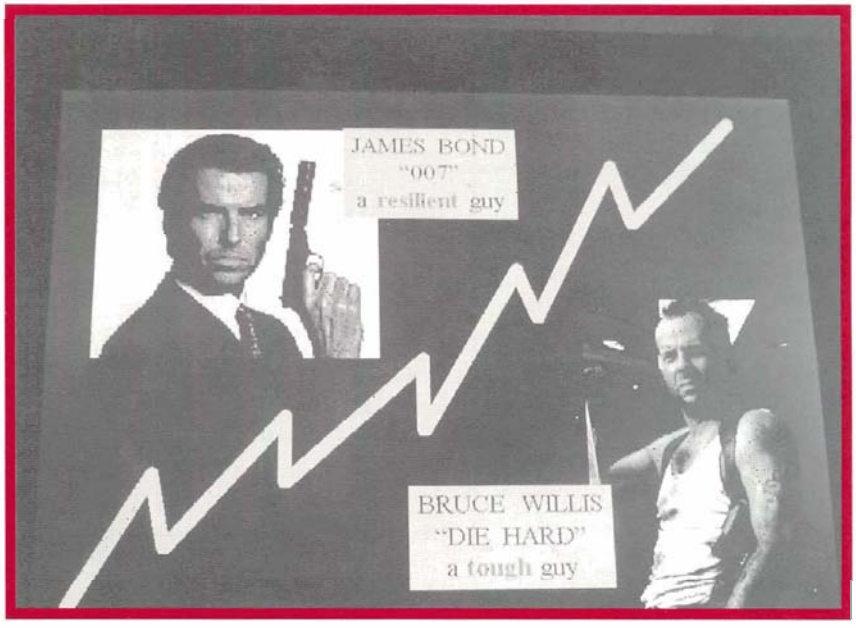
"I started slowly. First I put just the syllabus on the Web, then I started adding other things —lecture notes, problems. This is my fourth semester using the computer," he said.

Since then he has learned the Golden Rule of the multi-media approach — be prepared. The examples used in class have to be flawless; one false move and the audience can turn against you. "It is not acceptable to students if you hesitate or fumble finding the right numbers to use in examples. You lose them," he said. "Their attention and the attraction to the material is gone. It's got to be perfect, so it takes longer to prepare a lecture.

"I've been teaching different courses for the past few semesters, so the amount of preparation has been incredible. When I teach a class for the second time, hopefully the preparation time will go down."

Resasco uses computers in what he sees as a three-sided approach — for the lecture itself, for simulations and problem-solving, and for review and homework.

The professor said there are several advantages to using the laptop over more conventional lecture styles. For one thing, it introduces the material in a very visual way, something a generation raised on Sesame Street and MTV latches on to quickly. Another bonus the laptop has is its mobility.



Resasco uses examples to which students can easily relate. James Bond typifies resilient properties. He can take the heat, Resasco says, and remain unscathed. Bruce Willis is the model for tough properties. He can take abuse, but it leaves its mark.

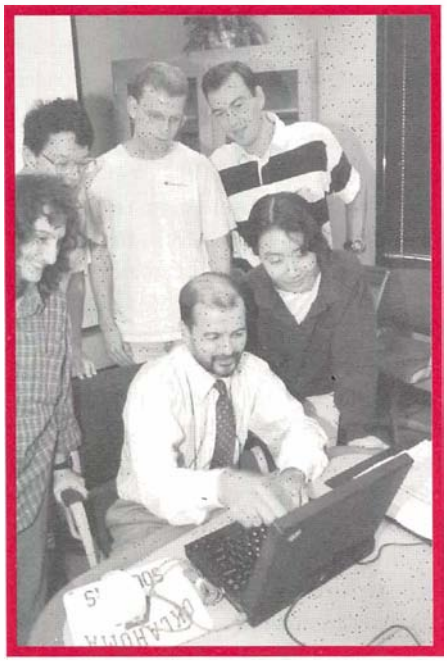
Daniel Resasco

When using slides or overheads the lecturer is virtually tethered to the projector. But with the use of a laser pointer, Resasco is free to walk around the classroom, visiting from desk to desk, answering questions, wielding his miniature light saber, like a good-natured Darth Vader turned academic.

For the lecture presentation, Resasco downloads pictures from the Internet, and utilizes various software and a CD drive to give his presentations impact. "With a regular lecture, I could describe a foundry, but with the CD drive, I can actually show a blast furnace going full fire. So that's very nice. I used to bring the video, but that plays with the dynamics of the class. If you have to stop, turn out the lights, put the video in, half the students go to sleep. When you have it on computer, it's right there."

After he has captured their attention and imagination with the presentation of the subject matter, Resasco goes into Phase II, problem-solving. "We've had the show, now it's time to be quantitative. This is where it will be nice to have students bringing their laptops to class," said Resasco, referring to the mandatory laptop rule that goes into effect next fall. "When the students bring their computers, they can actually do problem-solving in class. No one in my class currently brings a laptop. I think it will really be good for this part when they do."

Resasco uses Excel software to make simulations and to plot equations. "You can plot an equation on the blackboard, but what you can do with the computer, that you cannot do with anything else, is show how, when something varies, the curve moves. And on the screen it actually moves," he said. "You have all the parameters here. What happens if the rate constant increases? You can see instantly how the graph changes. You can tell the students the concentration changes with this and that, but if they actually see it, they can grasp it. And it takes one second." This is unique, Resasco said. Not to mention dramatic.



Resasco and students (clockwise from lower left) Lorena Serventi, Wei-li Yuan, David Larkin, Jose Santamaria, and Ya-Huei Chin look over a problem from class. His Web address is http://www.ou.edu/catalysis or resasco@uoknor.edu.

The third phase of computer as teaching tool occurs after the students have left the classroom. From their dorms, living rooms, or computer labs, students access Resasco's Web site. There they find lecture notes and homework assignments. They complete their homework on the computer and send it to Resasco electronically. After the deadline for the assignment has passed, Resasco makes the solutions available on the Web, so students can see how they did and how others solved the problems.

An example: an important part of structure and properties class is being able to see molecules in three dimensions. For this, Resasco said, the book simply doesn't work. But on the screen you can not only see a ceramics molecule, you can turn it around, examine it from all angles. "Then I give related exercises in things like naming planes," he said. "Usually, this might be kind of boring, but on the computer you can see where the plane cuts. And the computer will also tell you if you are right or not. It's a self test, and you must get the right answer before you can go on."

The quality of the students' work has improved a lot through the use of electronic homework, Resasco said, and their assignments now have a very professional look. "It also saves a lot of paper," he added with a smile.

Currently sophomores, at first, might have a little trouble using the computer to its full advantage, so he makes assignments available to them two ways, on the Web and in hard copy. Sophomores are not required to submit homework electronically.

The most important thing about the multi-media method for Resasco is the transmission of an idea, lighting that initial spark. "To grasp the first concept, it is important to see things concretely, to be able to visualize, but then you need to reflect to understand it," he said. "You still have to work for that. The computers will never eliminate the reading and individual work. Otherwise, students will become button pushers."

He said he will also limit the amount of time students can use their laptops in class. "When I teach, I like to be the center of attention," he said. "If everyone is working on their own screen, they are not paying attention to the lecture. So, what I will do, is lecture for awhile, then let them work in small groups. That will be really good — to be able to let them try immediately the things we have just discussed in

When asked if he sees an increased use of computer presentations in his classroom, Resasco shakes his head. "We'll have to see. I don't want to make the class too visual. The danger is when you do that, you are lacking in the abstract or conceptual part. So you have to strike a balance. It is important to see how things work in order to understand. Then a student needs to reflect, to work by him or herself. The pencil and paper is still pretty good for that."

Lance Lobban is an Associate Professor with a Ph.D. in Chemical Engineering from the University of Houston, 1987, and a B.S. from the University of Kansas, 1981.

He has worked with University Technologies, Inc., Conoco, Inc., and National Cooperative Refinery Association, and authored numerous publications.

His teaching awards include the Regents' Award for Superior Teaching, Outstanding Chemical Engineering Instructor (2x), OU Student Association Outstanding Professor in the College of Engineering, Baldwin Study/Travel Award for Excellence in Undergraduate Teaching, and Mortar Board Top Ten Faculty, University of Oklahoma. He has also been honored with the Gulf-Western Engineering Lectureship Award, the Richard M. Cyert Outstanding Team Award, a Texaco Research Fellowship, a DuPont Ph.D. Fellowship in Chemical Engineering, and an NSF Graduate Fellowship.

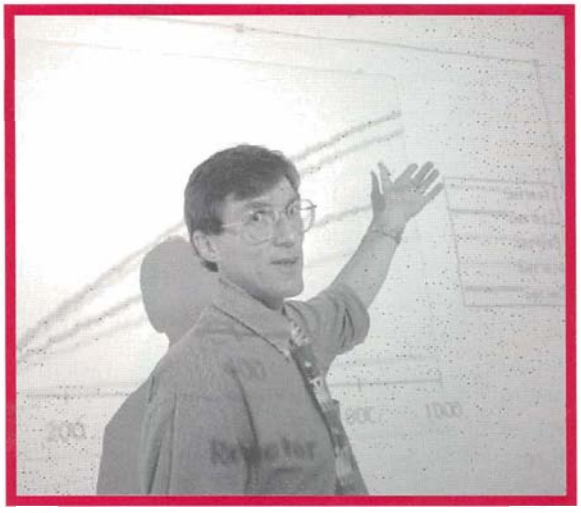
Lance Lobban isn't particularly interested in giving the perfect lecture, or receiving a long, detailed report from his students. These things, he says, are secondary. His primary goal goes beyond the classroom, into devising better methods to prepare his students for the workplace and for future careers. "Surveys show that what gives students an advantage today is to be able to communicate and write nice, clear letters. It's fine to write a 50-page report for your lab, but if you write something for your boss, it's three pages; your boss' boss, one page; and any higher than that, probably a paragraph," he says.

Of equal importance, he says, is the ability to work effectively in teams. "Today, students must be able to interface with all groups, from mechanical engineers to accountants. Because the issues are multi-disciplinary, they must solve not only technical problems, but safety, environmental, and public relations issues. They need to be able to work well as leaders, facilitators, or group members."

While looking at the research, Lobban further discovered that lecturing was not a very effective way of communicating information, even though the practice of writing facts as well as listening to them helped retention. Gone are the days, he says, of courses which focus on math and chemistry problem-solving. "When I was in school we sat at a desk and took notes unless the professor asked a question. Then, you either decided to respond or avoided eye contact," he grinned.

Today, he's decided that the most effective way to help his students learn to communicate and interact is via the computer and the Web. "One thing computers have done is streamline work. They move it outside the classroom, because everyone has access to the Web. It saves time for my students and for me to put assignments and lectures on our Web page," he notes.

To make his class more interactive, Lobban has moved into instructional modules and interactive multi-media assignments which can be performed on the computer. He took a class to learn how to produce interactive instructional modules, where the computer demonstrates a problem, poses a question, and proceeds according to the way students respond. The biggest difficulty with this method, he says, is that not all students



Lobban demonstrates a problem by projecting a graph on the screen from his laptop.

Lance L. Lobban

have the necessary hardware, and downloading files over the Web sometimes makes them too big.

He finds that most students have MicroSoft Excel and MicroSoft Word, and he posts spreadsheets on the Web in Excel for students to download and run. Interactive instructions must be packaged with a player program, although this makes file size very large.

He also lectures less these days. In addition to computer work, his classes incorporate more group activities, including oral presentations and exercises which require team skills such as critical thinking and problem solving, into his classes. "Teaching today requires a totally new approach. We're now facilitators and advisors, rather than lecturers. Right now there are only about half a dozen books on how to introduce computers and interactive learning into the classroom. That will change, because I see this as a continuing trend," he says.

One of the biggest nods to computer technology comes in the edict that all of next year's College of Engineering freshmen will be required to have laptop computers. "In four years, when all students have computers, we'll use them to take tests, run simulations, and solve demonstrations during class. They'll be tied together via radio frequency or infrared, so that students may access the Web from their desks," remarks Lobban.

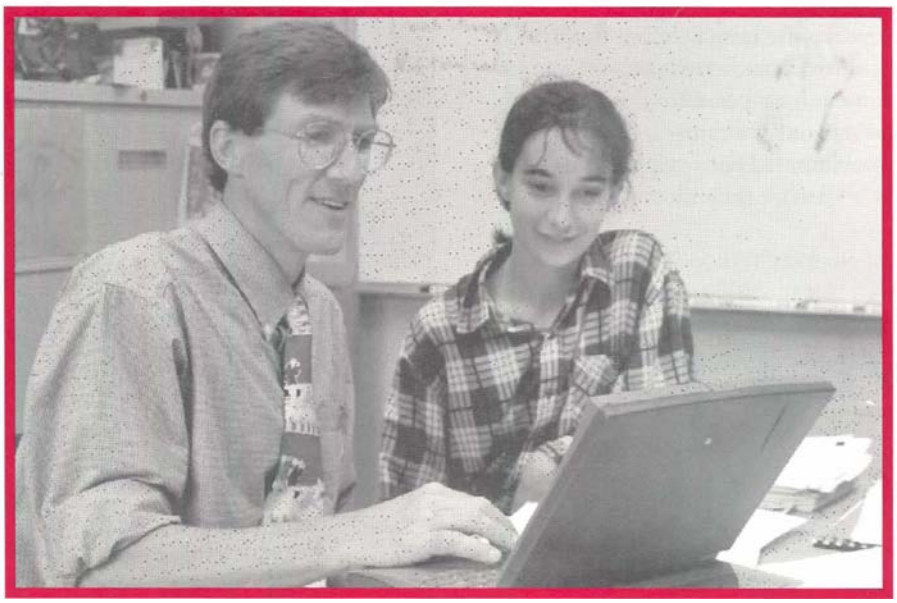
Another factor which has speeded up the focus on interdisciplinary learning is the change in College of Engineering accreditation. "We used to be able to show that students had a certain number of math or chemistry hours; now we must show that students are accomplishing specific educational outcomes. The focus is more outwardly based, and vaguer: we need to show that students can put engineering solutions into a societal context," he continues.

One of the byproducts of a more global approach to chemical engineering is an increasing emphasis on ethics in the workplace. Lobban notes that many students tend to think of a technical solution first, without considering the more far-reaching impact of their work. Situations today encompass so many factors that he says students need to learn to consider the ethical ramifications of a project.

Although Lobban still sees a large number of graduates going to big companies when they leave OU, he sees a growing number going to smaller niche markets. He tries to prepare students to work overseas in an increasingly global market. "Lots of work is being done on the Pacific Rim—Malaysia, Singapore, Thailand, and soon Vietnam," he says. "Perhaps in the future we may require our students to have a second language, especially Chinese, to prepare them for their work," he muses.

Lobban is enthusiastic about the direction of the Chemical Engineering program, and brims with ideas on how to make it even more relevant for graduates. Although it would be a huge undertaking, he sees the eventual need to take the interdisciplinary approach to problem-solving even further, partnering with other colleges, especially the business school, to simulate real-life problem-solving teams. Having twice taught at the Petroleum and Petrochemical College of Chulalongkorn University in Bangkok, Thailand, he also speculates on the importance of a class on cultural nuances, given the increasingly global scope of chemical engineering. "Although most cultures are willing to be forgiving of our mistakes—they certainly were with me!—little things make a big difference in the impression you make," he says.

Lobban's forward-thinking approach to teaching has left a lasting impression. His numerous teaching awards, given by faculty and regents, also include one voted by the students themselves. Lobban was selected Outstanding Professor in the College of Engineering by the OU Student Association. "I think the students can tell I get a big kick out of the whole teaching process," he says. ■



Lobban works with student Elizabeth Fayard on a simulation.

Miguel Bagajewicz is an Associate Professor with a Ph.D. in Chemical Engineering from the California Institute of Technology, 1987, an M.S. from Caltech, 1984 and a B.S. from the Universidad Nacional del Litoral, Argentina, 1977.

He worked for Intec, Argentina, in the areas of process engineering, and has authored numerous publications on these subjects, including 25 papers to various Congresses. In 1995 he served as visiting lecturer at UCLA on process economics and process design.

He has received the Presidential Travel Award at the University of Oklahoma, was a research fellow on the Argentine Atomic Energy Commission, and received an Argentine National Research Council and Inter-American Development Bank Fellowship.

Bagajewicz uses judo demonstrations to introduce ethics discussions in class.

Miguel Bagajewicz takes pride in the fact that his teaching career has evolved to the point that he almost never gives or receives a written assignment. He hasn't turned those tasks over to a graduate assistant, and his characteristic passion for his profession remains undimmed; he has simply eliminated hard-copy assignments. All work is conducted over the Web.

"It's not that every workplace is electronic," he points out. "But at least one chemical engineering class should teach students how to work with that medium. I worked in a company where all communication was electronic. We always passed copy through the Web. It's a trend which speeds up communication and makes the workplace more efficient. We should prepare students to face these things," he says.

Bagajewicz insures that his students are proficient on the Web by incorporating lecture materials and class announcements in his homepage. Students may browse for their grades and standing, and submit assignments in MicroSoft Word through the Web.

He's been using this approach for about a year, since he and Daniel Resasco, another chemical engineering professor, created their own Web pages to run their courses. He found that using the Web helped him break down complex problems into specific pieces. He could create a spread sheet, prepare it to a certain point, and have his students download and solve it. They didn't have to take the time to build the whole problem from scratch; they could focus on one part. He also found computers superior to traditional forms of problem-solving when performing simulations.

Miguel Bagajewicz

Not that the change has come easily, for Bagajewicz or his students. "I've had to move slowly in this new approach. I can't hit them with it like a cold shower, where suddenly everything is different. Young people are much more prone to accept a new technology, but, amazingly, I've had about 10% of my classes saying, 'I would rather not send you e-mail. I'd rather do homework in written form.' I wouldn't have thought that."

He also notes that there are limits on what he can do alone. "There are plenty of interactive programs out there, but I don't want to become a computer programmer instead of a teacher. We need to maintain a balance so that the technology doesn't take over the class."

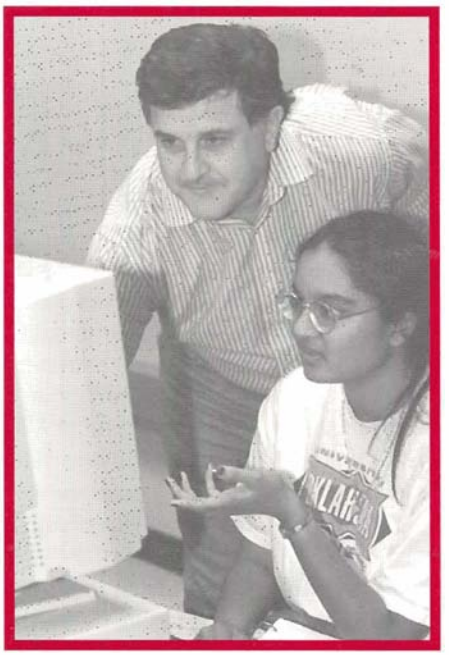
The advent of the laptop program next year, which mandates that all incoming freshmen have a laptop computer, will precipitate changes in all classes. "This will change the way all of us lecture. With everyone connected to the Web, I'll be able to use my projector and exchange information with the students. It will allow all of us, as teachers, to move forward together. We cannot change at different paces, or the students resist," he says.

Bagajewicz believes that one way to better prepare students for the workplace is to switch from a grading-oriented to a learning-oriented scenario. For this reason, his grading system is unique in engineering. At the first of the semester, he contracts with the students for a grade, with certain assignments completed satisfactorily equaling a letter grade. He corrects, rather than grades, homework, and it's not complete until it's done to his entire satisfaction. "This prepares people for their jobs. When you work in an office, there is an implicit contract. You do the task until it's finished; you don't do what you can and then stop. You must perform 100%; 98% is not enough. This is the real life approach."

But, he adds, there must be a balance. "It's nice to mimic real life, but we must remember that the student has a personality. He's thinking this is his last year, his senior year, and he wants to have some fun. We should allow that. We can't make college be completely like real life."

Another theory which he firmly advocates is that the professor who teaches the class shouldn't be doing the grading. He sees the two roles as conflicting. "The professor should be engaging with students who want to learn, not thinking about grade point averages," he says.

Good team skills are also important for students. Bagajewicz addresses all ends of the spectrum. "We must have leadership, but followership is important too. Not everyone can be a leader, nor would a project succeed if there weren't people to take the other roles. I try to stress both areas," he says.



Bagajewicz helps Subha Varahan through a thorny problem in the computer lab.

Many of Bagajewicz's teaching philosophies are guided by his lifelong interest in judo. The sport emphasizes ethical principles, which he tries to convey to his students. He incorporates ethics discussions into his lectures, and tries to present his students with open-ended situations which require them to make a choice. "Industry says that students need more practice in group work, and that we do too little creative work with too much analysis," he adds. Judo is also convenient in spicing up a lecture, and he's been known to perform demonstrations in class. "It's part of the show," he grins.

To Bagajewicz, the payoff in teaching comes when students push their limits in learning. "The assignments I give depend on the crowd. I've had good years and bad years, and if a group is less receptive, I have to adjust my expectations. The danger in pushing students is that sometimes you push them too far; they say it's too much, " he says.

"The trick is to get them in a good mood, keep suggesting things to do, don't give them the full story all at once. They're proud of their accomplishments, and before they know it they're doing more than they thought they could. Once I had to stop a student, tell him 'this is enough.' That was rewarding. To this day he calls to keep in touch."

Bagajewicz's knowledge of the latest technology and an ability to inspire students to sample that technology make for a good teaching philosophy, one which will never become obsolete. ■

Institute For Applied Surfactant Research Celebrates 10th Anniversary

This year marks the tenth anniversary of the Institute for Applied Surfactant Research at the University of Oklahoma. Three chemical engineering professors, Jeffrey H. Harwell, director of the School of Chemical Engineering, John F. Scamehorn, associate director of the institute, and Edgar O'Rear, assistant dean in the College of Engineering, have been with the institute since its inception. Today, the IASR consists of seven OU faculty members from various disciplines who have joined forces to find surfactant-based solutions to some of the toughest problems facing industry and the nation today.

"We didn't start out, saying, hey, let's form an institute," said Scamehorn. "But over the course of time we began to realize that among us, we had a lot of surfactant research going on at the University, and more and more it was of a collaborative nature. So we decided we could formalize all this work on surfactants under one umbrella and together offer industry a critical mass of researchers and agencies under one roof."

In addition to Scamehorn, Harwell, and O'Rear, members of the institute are Sherrill D. Christian, director and George Lynn Cross Research Professor in Chemistry; and Bing M. Fung, professor of chemistry. About five years ago, two civil engineering and environmental science faculty, Robert C. Knox and David A. Sabatini, joined the IASR ranks, strengthening its interdisciplinary research efforts. In addition to the faculty, there are around 50 graduate students and post docs working with the institute. The five main areas of study are 1) surfactant-based separations 2) consumer product research 3) environmental research 4) ultra-thin films and 5) bio-medical research.

"We call this our 10th year anniversary because we had a big organizational meeting in the spring of '87, and invited all our industrial friends to see what we had to offer," said Scamehorn.

The seven faculty members of the Institute of Applied Surfactant Research represent three disciplines at the University of Oklahoma. They are (from left) David A. Sabatini, Robert Knox, Sherril D. Christian, Edgar A. O'Rear, John F. Scamehorn, Jeff Harwell, and Bing. M. Fung.

They must have liked what they saw. The institute, which came into being with no corporate funding has, in the past decade, put together a consortium of nearly 20 companies. Some of these sponsors are among the largest manufacturers of consumer products, surfactant manufactures, oil companies, and chemical companies. "It's satisfying that people in so many different areas see a value to the research we're doing," said Harwell.

In addition to support from the private sector, the institute has enjoyed a large number of government contracts through the Department of Energy, the National Science Foundation, the Environmental Protection Agency and the Department of Defense.

"Our success in getting government contracts is directly related to our reputation," said Scamehorn. "We are one of the top research organizations related to colloids and surfactants in the world. We estimate our average expenditures in the institute are around half a million dollars. So the industrial support is actually a small part of our total funding."

In the ten years since the formal establishment of the institute, there has been increased demand for projects that reflect a growing concern for the environment. Five of the IASR's seven members are currently working on soil and ground water remediation. "We're one of the three or four leading institutes in the world in applying surfactants to environmental remediation," said Harwell.

"We've also been doing a lot of work in the last five years in the recycling of both paper and plastics," added Scamehorn. "By removing the ink, or

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Surfactant, *continued from page 12*

de-inking using surfactants, companies will be able to reuse these materials, and that will, of course, reduce the land fill usage.

"We have also pushed forward the knowledge base in several areas related to consumer products, in understanding surfactant precipitation and absorption. This means we can formulate effective laundry detergents without the use of phosphates," explained Scamehorn. "It means we can use concentrated detergents more effectively, which helps the environment by saving on packaging and shipping."

Another important area of research is the ultra thin film process which uses surfactants as a template to put an ultra thin film as small as 50 angstroms on a surface. This changes the properties of the surface, so, for example, it can increase the dispersibility of pigments of paint. Much of the research in the thin film area at the institute focuses on improving the performance of reinforced elastomers and plastics. It also shows potential for corrosion inhibition. The biomed projects, such as artificial bloods and drug delivery systems are also becoming increasingly important.

An ongoing goal members have for the institute is to become a federally sponsored national center for surfactant research. "Our work with companies has led us to grants from the DOE, EPA, and the NSF," said Harwell. "To be funded as a national center by one of these agencies would increase both availability and stability of funding and would be a very good step for us."

"One thing I really enjoy in working with the institute is helping companies find engineering solutions to their problems," said Harwell. " I've found companies that face problems every day which *have* to be solved. We're forced to look at solutions to chemical engineering problems which we never knew existed. It puts us in contact with exciting new phenomena and brings us challenges we would never see if we stayed confined to the classroom." ■

New Faculty

Melissa M. Rieger joined the University of Oklahoma family in August. She is the first female faculty member in the School of Chemical Engineering and Materials Science.

She received her Ph.D. in Chemical Engineering in September 1997 from Georgia Institute of Technology in Atlanta with the dissertation, *The Electrochemical Etching of Silicon in Nonaqueous Solutions*. She received her B.S. in Chemical Engineering from Virginia Polytechnic Institute and State University with a minor in chemistry.

Reiger has been the recipient of numerous awards including the Intel Foundation Graduate Fellowship, which is granted to only 30 Ph.D. candidates nationwide; the President's Fellowship at Georgia Institute of Technology; Eastman Kodak Scholarship for Chemical Engineering; and the Felix A. Sebba Memorial Scholarship Award in Chemical Engineering.

Melissa M. Rieger

She has worked in academics as a full time graduate student with both research and teaching assignments and has worked in industry for Eastman Chemical Company. She will teach Structures and Properties of Materials in the spring. ■

Alumni Notes

Chem. E. Alum Knighted

University of Oklahoma Chemical Engineering alumnus, Dr. William W. Talley II, Royal Danish Consul for Oklahoma, has been appointed Knight of the Order of Dannebrog by Her Majesty Queen Margrethe II of Denmark.

The Order of the Dannebrog is a Danish order of chivalry, which may be awarded to Danes and foreign citizens for meritorious civil or military service, for a particular contribution to the arts, science or business life or for working for Danish interests. The honor was given in recognition of Talley's assistance to Danish citizens and for the enhancement of Danish culture and awareness in the United States.

The Hobart native earned BS and MS degrees in chemical engineering, a second master's degree in nuclear engineering and doctoral degrees in nuclear and chemical engineering, all from OU.

Talley was named Honorary Consul of Denmark in 1988, and is authorized to handle passports, visas and national election balloting for Danish citizens living in Oklahoma. He is the founder and chairman of the board of the RAM Companies and has served as Chairman

See Alum Knighted page 14

Alumni Notes

OU Alum Edits ChemE "Bible"

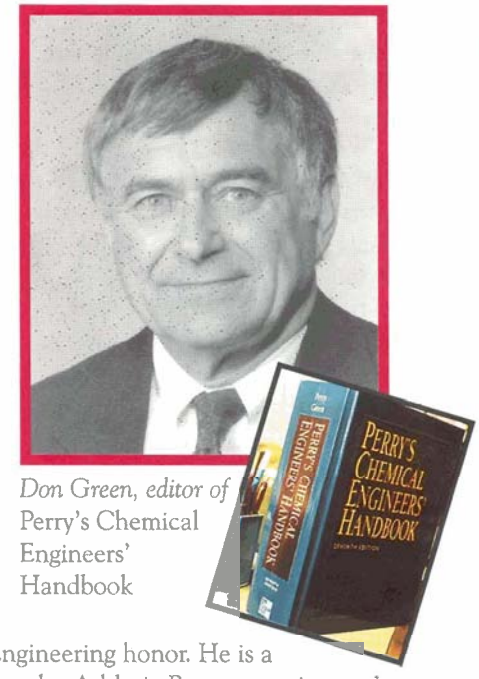
Don Green, University of Oklahoma Chemical Engineering alumni and past member of the OkChE Advisory Board, has edited the Seventh Edition of *Perry's Chemical Engineers' Handbook.*

Green met Robert H. Perry at OU as a doctoral student when Perry was his advisor. The two became close friends, and stayed in touch when Green graduated and moved to Ponca City to work for Conoco. After a short stint there, he decided to go back to teaching, relocating to Kansas University to teach in chemical and petroleum engineering.

It was in 1977 that Green received a letter from Perry inviting him to come to London to discuss co-editing the seventh edition of the handbook. Green and his wife traveled there over spring break, where he did section editing on the sixth edition and made plans for the seventh. Six months later, Perry was killed in a pedestrian accident in London. Green, as heir apparent, completed the sixth edition, which went to press in 1984. That book, the 50th anniversary edition, sold over 190,000 copies, including Spanish translations. Green and Jim Maloney, professor emeritus at KU, went on to edit the 7th edition, which came out in 1996.

The first Perry's handbook was edited by Robert Perry's father, John, in 1934. New editions have come out every 10 to 13 years. The current edition has over 100 contributors, and took about eight years to complete.

Don Green is currently Chair and Deane E. Ackers distinguished professor of chemical and petroleum engineering at the University of Kansas in Lawrence. He has won several teaching awards, including the Hope Award, voted by college seniors, and is a four-time winner of the Gould Award, a School of Engineering honor. He is a Faculty Athletic Representative to the Big 12, a fellow of the AIChE, and a distinguished member of the Society of Petroleum Engineers. ■



Don Green, editor of Perry's Chemical Engineers' Handbook

Alum Knighted, *continued from page 13*

of the Oklahoma Governor's Advisory Council on Energy, the Governor's Environmental Council, the Oklahoma Center for Applied Science and Technology, the Higher Education Alumni Council, the Oklahoma School of Science and Mathematics, and the World Affairs Council. He also served as a U.S. Navy nuclear submarine officer.

The Hobart native earned BS and MS degrees in chemical engineering, a second master's degree in nuclear engineering and doctoral degrees in nuclear and chemical engineering, all from OU. Talley and his wife, Sandy, live in Oklahoma City. ■

Distinguished OU alumnus William W. Talley II (left) receives the badge of the Order of the Dannebrog from Ambassador Bent Kiilerich, Consul General of Denmark, in ceremonies earlier this year at the Oklahoma City Golf and Country Club.

Research Grants Awarded

Daniel E. Resasco, Chemical Engineering and Materials Science
State of Oklahoma, Center for the Advancement of Science and Technology
January 1, 1997 - December 31, 1997
Sulfur Resistant Catalysts for Aramoatization of C6 and C7
$96,292.00

Richard Mallinson, Energy Center Institute
Lance Lobban, Energy Center Institute
Kenneth Nicholas, Energy Center Institute
Daniel Resasco, Energy Center Institute
U.S. Department of Energy
May 13, 1997 - May 12, 1998
Novel Catalytic Approaches for Hydrogen Production
$74,000.00

Roger Harrison, Jr., Chemical Engineering and Materials Science
National Science Foundation
REU Supplement: Genetic Engineering to Enhance the Solubility of Proteins in Escherichia Coli and Improve Protein Purification
$5,000.00

Sherril Christian, Institute for Applied Surfactant Research
John Scamehorn, Institute for Applied Surfactant Research
Oklahoma Alliance for Public Policy Research, Inc.
January 1, 1997 - December 1, 1997
Deinking of Plastic Packaging Materials
$45,000.00

Lloyd Lee, Chemical Engineering and Materials Science
NM Technologies
May 15, 1997 - May 15, 1998
Gas Adsorption on Novel Adsorbents
$15,626.00

David Sabatini, Institute for Applied Surfactant Research
Jeffrey Harwell, Institute for Applied Surfactant Research
DOW Chemical U.S.A.
Extend to July 31, 1998
Mechanisms for Enhancing the Solubilization Potential of DOWFAX Components
$32,928.00

Jeffrey Harwell, Chemical Engineering and Materials Science
Lance L. Lobban, Chemical Engineering and materials Science
National Science Foundation
Extend to August 31, 1999
Graduate Research Traineeships in Environmentally Friendly Natural Gas Technologies
$112,500.00

Robert Knox, Institute for Applied Surfactant Research
Jeffrey Harwell, Instutute for Applied Surfactant Research
David Sabatini, Institute for Applied Surfactant Research
Trust Environmental Services, LLC
Prime is NSF
January 1, 1997 - June 30, 1997
Surfactant-Enhanced Subsurface Remediation of Petroleum Hydrocarbons
$14,400.00

Edwin Tucker, Institute for Applied Surfactant Research
Jeffrey Harwell, Institute for Applied Surfactant Research
John Scamehorn, Institute for Applied Surfactant Research
U.S. Department of Defense, Naval Facilities Engineering Command
June 23, 1997 - February 28, 1998
Design and Build Micellar-Enhanced Ultrafiltration (MEUF) Units
$163,167.00

Robert Shambaugh, Chemical Engineering and Materials Science
Weyerhaeuser Company
June 5, 1997 - August 30, 1997
Melt Blowing Die
$1,000.00

Jeffrey Harwell, Chemical Engineering and Materials Science
Jerry Newman, Chemical Engineering and Materials Science
Surfactant Associates
July 1, 1997 - June 30, 1998
Oxidation of VOCS Via an Ozonated, Ultraviolet Irradiated Flurocarbon/TiO2 Dispersion
$14,521.00

Edgar A. O'Rear, III, Chemical Engineering and Materials Science
Oklahoma State University (NSF-EPSCoR)
Prime is NSF
Center for Photonic and Electronic Materials and Devices
$19,052.00

Matthias U. Nollert, Chemical Engineering and Materials Science
State of Oklahoma, Center for the Advancement of Science and Technology
June 1, 1997 - May 31, 1998
Selectin Mediated Adhesion in a Reconstituted System
$35,000.00

John Scamehorn, Institute for Applied Surfactant Research
Richard Taylor, Chemistry and Biochemistry
Department of Energy
September 1997 - September 2000
Removal of Radioactive Cations and Anions from Polluted Water Using Ligand-Modified Colloid-Enhanced Ultrafiltration
$422,219.00

John Scamehorn, Institute for Applied Surfactant Research
Sherril Christian, Chemistry and Biochemistry
D.W. Teeters, National Science Foundation
September 1997 - August 1999
Deinking of Plastic Packaging
$397,000.00

Program of Excellence
Scholars and Sponsors, 1997-1998

Kirk Allen
Tulsa, Oklahoma
Diamond Shamrock Co. Scholar

Rodney N. Alles, Jr.
McAlester, Oklahoma
Diamond Shamrock Co. Scholar

Quincy V. Amen
Bartlesville, Oklahoma
National Merit Scholar
Omer A. & Marjorie M. Pipkin/ Richard G. Askew Scholar

Gary A. Barber
El Paso, Texas
CEMS Associates Scholar

Jeffrey A. Blomgren
Wylie, Texas
Texaco Inc. Scholar

Lorna M. Bradley
Tulsa, Oklahoma
Shell Development Co. Scholar

Jill M. Brown
Brookfield, Wisconsin
National Merit Scholar
Richard L. Huntington/Richard G. Askew Scholar

Jason E. Bryant
Oklahoma City, Oklahoma
W.D. Owsley Scholar

Julio C. Cabrera
Coral Springs, Florida
National Hispanic Scholar
Laurance S. Reid/Richard G. Askew Scholar

Crystal N. Casey
Sherwood, Arkansas
National Achievement Scholar
Omer A. & Marjorie M. Pipkin/ Richard G. Askew Scholar

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Tulsa, Oklahoma
Sam A. Wilson Memorial Scholar

Russell Cook
Milburn, Oklahoma
CEMS Associates Scholar

Jaime Craig
Norman, Oklahoma
CEMS Associates Scholar

Jeremy J. Daniel
Pawhuska, Oklahoma
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Brian H. Daugherty
Claremore, Oklhaoma
CEMS Associates Scholar

Marcia Fassio
Krebs, Oklahoma
CEMS Associates Scholar

Zachary J. Frazier
Cushing, Oklahoma
CEMS Associates Scholar

Nilanjana "Lynn" Ghose
Tulsa, Oklahoma
Sam A. Wilson Memorial Scholar

Gregory R. Gonser
Great Falls, Montana
National Merit Scholar
Phillips Petroleum Co. Scholar

Brandon H. Grissom
Sulphur, Oklahoma
W.D. Owsley Scholar

Ginny M. Harris
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Laurance S. Reid/Richard G. Askew Scholar

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Sam A. Wilson Memorial Scholar

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Corvallis, Oregon
National Merit Scholar
CEMS Associates Scholar

Kathryn C. Keister
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Sam A. Wilson Memorial Scholar

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Colorado Springs, Colorado
CEMS Keys Scholar

David G. Larson
Aberdeen, South Dakota
National Merit Scholar
F. Mark Townsend Scholar

Jennifer D. Leath
Tulsa, Oklahoma
Sam A. Wilson Memorial Scholar

Tyler J. Mullins
Ada, Oklahoma
Shell Development Co. Scholar

Brandy S. Nolan
Oklahoma City, Oklahoma
CEMS Keys Scholar

Nancy S. Perkins
Edmond, Oklahoma
Shell Development Co. Scholar

Katia Perry
Gorizia, Italy
Shell Development Co. Scholar

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Shell Development Co. Scholar

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National Merit Scholar
CEMS Keys Scholar

Ryan D. Reese
Duncan, Oklahoma
Phillips Petroleum Co. Scholar

David B. Roberts
Oklahoma City, Oklahoma
Phillips Petroleum Co. Scholar

Teresa N. Schachle
Cordell, Oklahoma
CEMS Keys Scholar

Sandra Y. Snyder
Menomenee Falls, Wisconsin
Phillips Petroleum Co. Scholar

Jennifer M. Strojny
Biloxi, Mississippi
National Merit Scholar
Sam A. Wilson Memorial Scholar

Venkatesh Thiyagarajan
Bartlesville, Oklahoma
CEMS Keys Scholar

Jeffrey W. Thornton
Norman, Oklahoma
Sam A. Wilson Memorial Scholar

Subha L. Varahan
Norman, Oklahoma
CEMS Keys Scholar

Jill L. White
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CEMS Keys Scholar

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Joshua D. Wood
Holdenville, Oklahoma
CEMS Keys Scholar

Matthew Yarrison
Parker, Colorado
National Merit Scholar
CEMS Keys Scholar

Scamehorn, *continued from page 5*

By the time they have finished ENG 1112, students will be adept at Excel, understand basic economic and statistical combinations, and have a good background of engineering safety and ethics. Perhaps the most important lesson they will learn is how engineers approach problems and the methods they use to arrive at engineering solutions.

Freshmen are also required to take ENG 1001, a computer class designed to introduce students to computer programming. There is some argument as to whether the average engineering student still needs to know how to program computers with the wide variety of software currently available. But, for now, Scamehorn said, "we still have them learn some programming."

"I think it's necessary for them to be engineers," Scamehorn said. "Students who get out in industry will be using computers for almost all their calculations. So learning on a computer helps us train them for the real world. But it doesn't take the place of human evaluation."

"Ten years ago, my calculator broke and I pulled out my slide rule to do a calculation and the student's eyes got really big. He wanted to know if that was an abacus," Scamehorn smiled.

Even in today's high-tech world, an ability to be resourceful may be the best tool an engineer can have. ■

John F. Scamehorn is the Asahi Glass Chair/George Lynn Cross Research Professor and has won numerous awards, including the Regents Award for Superior Research. He received his B.S. and M.S. in Chemical Engineering from the University of Nebraska, and his Ph.D. from the University of Texas. He has worked for Conoco Chemicals Research, Shell Development Co., and DuPont. His work with surfactants has been funded by NSF, PRF (ACS), DOE, Bureau of Mines, Center for Waste Reduction Technologies, EPA, TAPPi, U. S. Army, Shel, Arco, and Mobil. He is an associate editor of the soaps and detergents section of the Journal of the American Oil Chemists' Society *and is on the editorial board of the* Journal of Colloid and Interface Science.

The University of Oklahoma is a doctoral degree-granting research university serving the educational, cultural and economic needs of the state, region and nation. Created by the Oklahoma Territorial Legislature in 1890, the University has 20 colleges offering 160 undergraduate degree programs, 125 master's degree programs, 79 doctoral programs, professional degrees in four areas and 20 dual professional/master's programs. OU enrolls more than 25,000 students on campuses in Norman, Oklahoma City and Tulsa and has approximately 1,500 full-time faculty members. The University's annual operating budget is $507 million.